

CLAIMS

1. A method for manufacturing a quartz oscillator characterized by having:

5 an outer shape etching step of processing a quartz oscillating piece into a predetermined shape by etching;

an electrode forming step of forming an electrode on the quartz oscillating piece processed into the predetermined shape;

10 a mounting step of mounting the quartz oscillating piece having the electrode formed thereon in an oscillator package;

a leakage oscillation adjusting step of driving the quartz oscillating piece mounted in the mounting step, detecting the leakage oscillation, and removing a part of the quartz oscillating piece depending on the detected leakage oscillation; and

re-etching step of re-etching the quartz oscillating piece subjected to the removal.

20 2. The method for manufacturing a quartz oscillator according to claim 1, characterized in that, in the re-etching step, the quartz oscillating piece is dipped in an etchant together with the oscillator package.

25 3. The method for manufacturing a quartz oscillator according to claim 1 or 2, characterized in that primary leakage oscillation adjustment which terminates mechanical removal before reaching a target value in prospect of a leakage oscillation adjustment amount in the

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re-etching step is carried out in the leakage oscillation adjusting step, and secondary leakage oscillation adjustment which etches the quartz oscillating piece until the target value is reached is performed in the re-etching step.

4. The method for manufacturing a quartz oscillator according to claim 3, characterized by having a small amount removing step of further removing a small amount of the quartz oscillating piece after performing the secondary leakage oscillation adjustment in the re-etching step.

5. The method for manufacturing a quartz oscillator according to claim 4, characterized by having a cleaning step of cleaning the quartz oscillating piece after performing the small amount removal.

6. The method for manufacturing a quartz oscillator according to any one of claims 1 to 5, characterized in that mechanical removal is performed with respect to the quartz oscillating piece in the leakage oscillation adjusting step.

7. The method for manufacturing a quartz oscillator according to any one of claims 1 to 5, characterized in that removal using a laser is performed with respect to the quartz oscillating piece in the leakage oscillation adjusting step.

8. The method for manufacturing a quartz oscillator according to any one of claims 1 to 7, characterized in that the removal with respect to the quartz oscillating piece in the leakage oscillation adjusting step is carried out to a driving leg including a driving electrode of the quartz oscillating piece.

9. The method for manufacturing a quartz oscillator according to claim 8, characterized in that the removal is carried out to a corner portion of the driving leg.

10. The method for manufacturing a quartz oscillator according to any one of claims 2 to 9, characterized in that a part of the quartz oscillating piece and the oscillator package is sealed with a resin and then dipped in the etchant.

11. The method for manufacturing a quartz oscillator according to any one of claims 2 to 10, characterized in that the etchant is hydrofluoric acid or a liquid containing hydrofluoric acid as a main component.

12. The manufacturing method of a quartz oscillator according to claim 11, characterized in that the liquid containing hydrofluoric acid as the main component is a liquid obtained by mixing ammonium fluoride with hydrofluoric acid.

13. The method for manufacturing a quartz

oscillator according to any one of claims 1 to 12,
characterized in that the quartz oscillating piece is
mounted in the oscillator package by using an adhesive, a
wire, an electroconductive adhesive and/or a ball bump in
5 the mounting step.

14. The method for manufacturing a quartz
oscillator according to any one of claims 1 to 13,
characterized in that the quartz oscillating piece has a
10 driving leg including a driving electrode and a detection
leg including a detection electrode, and

the method has a degree of detuning adjusting step
of setting a difference between a resonance frequency of
the driving leg and a resonance frequency of the detection
15 leg to a predetermined value in the re-etching step.

15. The method for manufacturing a quartz
oscillator according to claim 14, characterized in that a
degree of detuning adjusted in the degree of detuning
20 adjusting step is 180 ± 30 Hz or 200 ± 50 Hz.

16. A quartz oscillator characterized by being
manufactured by using the method for manufacturing a quartz
oscillator according to any one of claims 1 to 15.

25 17. The quartz oscillator according to claim 16,
characterized in that the quartz oscillator is a gyro.